What is claimed is:

1. An objective optical element to be used for an optical pickup device for performing reproducing and/or recording of information to a first optical information recording medium and a second optical information recording medium by converging a light beam having a wavelength $\lambda 1$ (640 nm $\leq \lambda 1 \leq$ 670 nm) on an information recording surface of the first optical information recording medium having a protective substrate thickness t1 (t1 = 0.6 mm), and by converging a light beam having a wavelength $\lambda 2$ (400 nm $\leq \lambda 2 \leq$ 415 nm) on an information recording surface of the second optical information recording medium having a protective substrate thickness t2;

wherein an optical system magnification m1 of the objective optical element to the light beam having the wavelength $\lambda 1$, satisfies a relation of $|m1| < 0.01$, the objective optical element has a numerical aperture NA1 of a converging spot formed on the information recording surface of the first optical information recording medium, and the numerical aperture NA1 satisfies a relation of $0.60 \leq NA1 \leq 0.70$, and

wherein an optical system magnification m2 of the objective optical element to the light beam having the wavelength $\lambda 2$ satisfies a relation of $|m2| < 0.01$, and the protective substrate thickness t2 satisfies a relation of 0.70 mm $\leq$ t2 $\leq$ 0.77 mm.

2. The objective optical element of claim 1, wherein the objective optical element comprises a single lens, and a dispersion value νd of a lens material of the single lens satisfies a relation of $\nu d \geq 50$.

3. The objective optical element of claim 1, wherein the protective substrate thickness t2 satisfies a relation of 0.72 mm $\leq t2 \leq$ 0.76 mm.

4. The objective optical element of claim 1, further comprising a correction function for suppressing a value of $|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 1.0 μm/nm or less, where ΔfB μm denotes a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

5. The objective optical element of claim 1, further comprising a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface.

6. The objective optical element of claim 5, wherein a correction function for suppressing a value of

$|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 0.1 µm/nm or less is obtained by the phase difference producing structure, where ΔfB µm denotes a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength λ2 and a light beam having a wavelength λ2′, respectively, when the wavelength λ2 of the light beam is changed to λ2′.

7. The objective optical element of claim 1, wherein the objective optical element is made of a glass material.

8. An objective optical element to be used for an optical pickup device for performing reproducing and/or recording of information to a first optical information recording medium and a second optical information recording medium by converging a light beam having a wavelength λ1 (640 nm $\leq \lambda 1 \leq$ 670 nm) on an information recording surface of the first optical information recording medium having a protective substrate thickness t1 (t1 = 0.6 mm), and by converging a light beam having a wavelength λ2 (400 nm $\leq \lambda 2 \leq$ 415 nm) on an information recording surface of the second optical information recording medium having a protective substrate thickness t2 (t2 = 0.6 mm);

wherein an optical system magnification m2 of the objective optical element to the light beam having the wavelength λ2 satisfies a relation of $|m2| < 0.01$, and

wherein an optical system magnification m1 of the objective optical element to the light beam having the wavelength $\lambda 1$ satisfies a relation of $-1/20 \leq m1 \leq -1/200$.

9. The objective optical element of claim 8, wherein the objective optical element comprises a single lens, and a dispersion value νd of a lens material of the single lens satisfies a relation of $\nu d \geq 50$.

10. The objective optical element of claim 8, further comprising a correction function for suppressing a value of $|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 1.0 μm/nm or less, where ΔfB μm denotes a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

11. The objective optical element of claim 8, further comprising a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface.

12. The objective optical element of claim 11, wherein a correction function for suppressing a value of $|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 0.1 μm/nm or less is obtained by the

phase difference producing structure, where ΔfB μm denotes a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

13. The objective optical element of claim 8, wherein the objective optical element is made of a glass material.

14. An objective optical element to be used for an optical pickup device for performing reproducing and/or recording of information to a first optical information recording medium and a second optical information recording medium by converging a light beam having a wavelength $\lambda 1$ (640 nm $\leq \lambda 1 \leq$ 670 nm) on an information recording surface of the first optical information recording medium having a protective substrate thickness t1 (t1 = 0.6 mm), and by converging a light beam having a wavelength $\lambda 2$ (400 nm $\leq \lambda 2 \leq$ 415 nm) on an information recording surface of the second optical information recording medium having a protective substrate thickness t2 (t2 = 0.6 mm);

wherein an optical system magnification m1 of the objective optical element to the light beam having the wavelength $\lambda 1$ satisfies a relation of $|m1| < 0.01$, and

wherein an optical system magnification m2 of the

objective optical element to the light beam having the wavelength $\lambda 2$ satisfies a relation of $-1/20 \leq m2 \leq -1/200$.

15. The objective optical element of claim 14, wherein the objective optical element comprises a single lens, and a dispersion value νd of a lens material of the single lens satisfies a relation of $\nu d \geq 50$.

16. The objective optical element of claim 14, further comprising a correction function for suppressing a value of $|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 1.0 μm/nm or less, where ΔfB μm denotes a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

17. The objective optical element of claim 14, further comprising a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface.

18. The objective optical element of claim 17, wherein a correction function for suppressing a value of $|\Delta fB/(\lambda 2 - \lambda 2')|$ to be 0.1 μm/nm or less is obtained by the phase difference producing structure, where ΔfB μm denotes

a distance in an optical axis direction between two converging spots formed by the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

19. The objective optical element of claim 14, wherein the objective optical element is made of a glass material.

20. An optical pickup device comprising: a first light source for emitting a first light beam having a wavelength $\lambda 1$ (640 nm $\le \lambda 1 \le$ 670 nm), a second light source for emitting a second light beam having a wavelength $\lambda 2$ (400 nm $\le \lambda 2 \le$ 415 nm), and a converging optical system for converging the first light beam having the wavelength $\lambda 1$ on an information recording surface of a first optical information recording medium having a protective substrate having a thickness of t1 (t1 = 0.6 mm), and for converging the second light beam having the wavelength $\lambda 2$ on an information recording surface of a second optical information recording medium having a protective substrate having a thickness of t2,

wherein the converging optical system comprises an objective optical element of claim 1.

21. An optical pickup device comprising: a first

light source for emitting a first light beam having a wavelength λ1 (640 nm ≤ λ1 ≤ 670 nm), a second light source for emitting a second light beam having a wavelength λ2 (400 nm ≤ λ2 ≤ 415 nm), and a converging optical system for converging the first light beam having the wavelength λ1 on an information recording surface of a first optical information recording medium having a protective substrate having a thickness of t1 (t1 = 0.6 mm), and for converging the second light beam having the wavelength λ2 on an information recording surface of a second optical information recording medium having a protective substrate having a thickness of t2 (t2 = 0.6 mm),

wherein the converging optical system comprises an objective optical element of claim 8.

22. An optical pickup device comprising: a first light source for emitting a first light beam having a wavelength λ1 (640 nm ≤ λ1 ≤ 670 nm), a second light source for emitting a second light beam having a wavelength λ2 (400 nm ≤ λ2 ≤ 415 nm), and a converging optical system for converging the first light beam having the wavelength λ1 on an information recording surface of a first optical information recording medium having a protective substrate having a thickness of t1 (t1 = 0.6 mm), and for converging the second light beam having the wavelength λ2 on an information recording surface of a second optical information

recording medium having a protective substrate having a thickness of t2 ($t2 = 0.6$ mm),

wherein the converging optical system comprises an objective optical element of claim 14.

23. The optical pickup device of claim 20, wherein the converging optical system comprises an optical element for carrying out a correction that a value of $|\Delta fB' / (\lambda 2 - \lambda 2')|$ to be 0.1 μm/nm or less, where $\Delta fB'$ μm denotes a distance in an optical axis direction between two converging spots formed by passing the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$ through the converging optical system, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

24. The optical pickup device of claim 23, wherein the correction is carried out by moving the optical element in the optical axis direction.

25. The optical pickup device of claim 23, wherein the optical element comprises a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface, and the correction is carried out by the phase difference producing structure.

26. The optical pickup device of claim 25, wherein

the phase difference producing structure is a diffractive structure for converging an n-th (n is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda1$ with the phase difference producing structure on the information recording surface of the first optical information recording medium, and for converging an m-th ($m \neq n$: m is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda2$ with the phase difference producing structure on the information recording surface of the second optical information recording medium.

27. The optical pickup device of claim 21, wherein the converging optical system comprises an optical element for carrying out a correction that a value of $|\Delta fB' / (\lambda2 - \lambda2')|$ to be 0.1 μm/nm or less, where $\Delta fB'$ μm denotes a distance in an optical axis direction between two converging spots formed by passing the light beam having the wavelength $\lambda2$ and a light beam having a wavelength $\lambda2'$ through the converging optical system, respectively, when the wavelength $\lambda2$ of the light beam is changed to $\lambda2'$.

28. The optical pickup device of claim 27, wherein the correction is carried out by moving the optical element in the optical axis direction.

29. The optical pickup device of claim 27, wherein the optical element comprises a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface, and the correction is carried out by the phase difference producing structure.

30. The optical pickup device of claim 29, wherein the phase difference producing structure is a diffractive structure for converging an n-th (n is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda 1$ with the phase difference producing structure on the information recording surface of the first optical information recording medium, and for converging an m-th ($m \neq n$: m is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda 2$ with the phase difference producing structure on the information recording surface of the second optical information recording medium.

31. The optical pickup device of claim 22, wherein the converging optical system comprises an optical element for carrying out a correction that a value of $|\Delta fB' / (\lambda 2 - \lambda 2')|$ to be 0.1 μm/nm or less, where $\Delta fB'$ μm denotes a distance in an optical axis direction between two converging spots formed by passing the light beam having the wavelength $\lambda 2$ and a light beam having a wavelength $\lambda 2'$ through the converging optical

system, respectively, when the wavelength $\lambda 2$ of the light beam is changed to $\lambda 2'$.

32. The optical pickup device of claim 31, wherein the correction is carried out by moving the optical element in the optical axis direction.

33. The optical pickup device of claim 31, wherein the optical element comprises a phase difference producing structure for producing a phase difference of a passing light beam on an at least one optical surface, and the correction is carried out by the phase difference producing structure.

34. The optical pickup device of claim 33, wherein the phase difference producing structure is a diffractive structure for converging an n-th (n is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda 1$ with the phase difference producing structure on the information recording surface of the first optical information recording medium, and for converging an m-th ($m \neq n$: m is a natural number) order diffracted light generated by producing a phase difference in the light beam having the wavelength $\lambda 2$ with the phase difference producing structure on the information recording surface of the second optical information recording medium.

35. An optical information recording and reproducing device comprising the optical pickup device of claim 20, wherein at least one of recording of information to the first optical information recording medium and the second optical information recording medium and reproducing of information recorded to the first optical information recording medium and the second optical information recording medium, is executable.

36. An optical information recording and reproducing device comprising the optical pickup device of claim 21, wherein at least one of recording of information to the first optical information recording medium and the second optical information recording medium and reproducing of information recorded to the first optical information recording medium and the second optical information recording medium, is executable.

37. An optical information recording and reproducing device comprising the optical pickup device of claim 22, wherein at least one of recording of information to the first optical information recording medium and the second optical information recording medium and reproducing of information recorded to the first optical information recording medium and the second optical information recording medium, is executable.